From Awareness to Action: Knowledge sharing for more gender-responsive animal and plant breeding

About gender in agriculture

Agriculture is under-performing because of women's unequal access to land, fertilizer, technology, extension and credit. At the same time agriculture also faces formidable challenges; from increased food demand to climate change impacts. Closing these gender gaps, therefore, is beneficial for not only women and men but also agriculture.

Setting the scene

Improved plant varieties and animal breeds developed through modern breeding deliver significant benefits for the rural poor, especially women. To ensure that the products of breeding programs meet farmers' and users' needs, it is critical for breeders to respond to clear differences in the priority that men and women assign to genetically determined traits.

Taking into account gender dynamics and such gender-differentiated preferences will make it more likely that farmers will adopt these new varieties and breeds that will help strengthen food and nutrition security. Breeding programs that overlook the specific trait preferences of female farmers and consumers not only further disempower these women but also put them at greater risk of remaining in poverty.

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Figure 1: Examples of gender-differentiated trait preferences

Women only	Men only
• Vigour • Tall height for ease of harvest • Well adapted to a diversity of growing conditions • Leafiness • Storage life • Ease of dehulling • Quantity of usable flour • Fuel'wood' quantity from stover • Cooking time • Taste, grain color	• Pest resistance • Resistance to water logging • Adapted to intercropping • Yield/ha • Suitability for local dish

Source: "Gender differentiation among farmer preferences for varietal traits in crop improvement." Weltzien, E., et al.

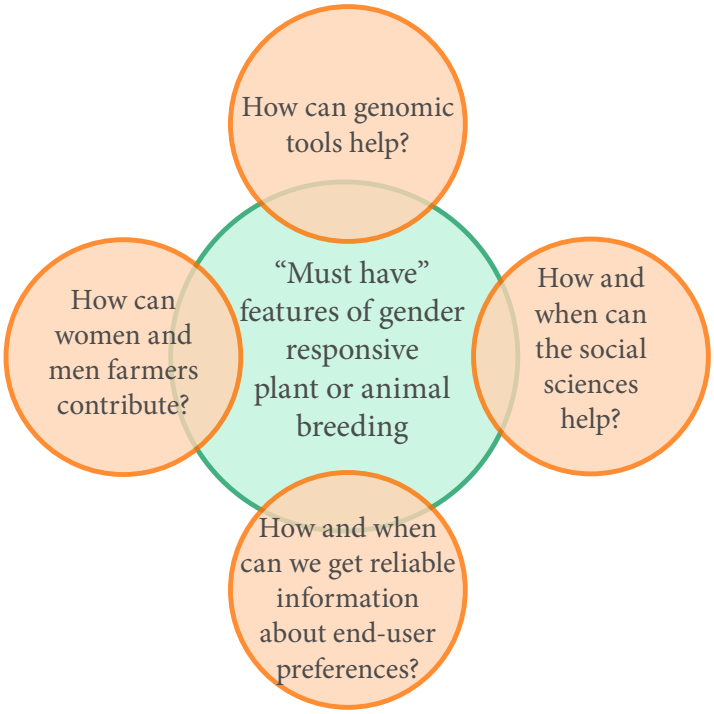
Addressing a major knowledge gap

The need for crop and animal breeding programs to consider gender differences was recognized long ago. Many breeders have come to understand the important effect of unequal relations between men and women end-users on access to new genetic material and the adoption of new varieties or breeds. The problem is that not nearly enough is known about practical ways to make breeding programs more gender responsive.

With the aim of helping to reduce this major knowledge gap, the gender and breeding working group of the CGIAR Gender and Agriculture Research Network organized a workshop on gender, breeding and genomics[1]. Held in Nairobi, Kenya, from 18-21 October 2016, the event stimulated an active exchange of ideas, reflecting different perspectives and experiences in breeding, genomics, and the social sciences.

Outputs from the workshop included suggestions about "must-have" features of gender-responsive plant or animal breeding (Mascarenhas, 2016), as well as practical ideas about what needs to be done and how to give programs these features, thus helping to bridge the gap between awareness and practice. The diverse mix of workshop participants, including both quantitative and qualitative scientists, allowed for a rich cross-fertilization of ideas from different disciplinary perspectives, which was reinforced by a call for case studies on the use of gender analysis in breeding.

Figure 2: Core questions posed at the first workshop on gender, breeding and genomics



The workshop posed a series of core questions shown in Figure 2. The discussion also included the question of "when?" in the breeding cycle each "must-have" feature could be addressed, because breeders make decisions about which different end-user preferences could be incorporated at all stages of the breeding cycle (Figure 3). Participants analyzed the questions through analysis and reflection of 12 case studies of breeding programs that took gender into account, as well as foundational inputs from the different disciplinary perspectives of breeding,

[1] Genomics is the branch of molecular biology concerned with the structure, function, evolution, and mapping of genomes (the complete set of DNA within a single cell of an organism).

genomics, and the social sciences, including the private sector.

This analysis, organized around the main stages of a breeding cycle (see Figure 3), also addressed these questions:

- What are the entry points in the breeding cycle where breeders can make use of information about gender dynamics?

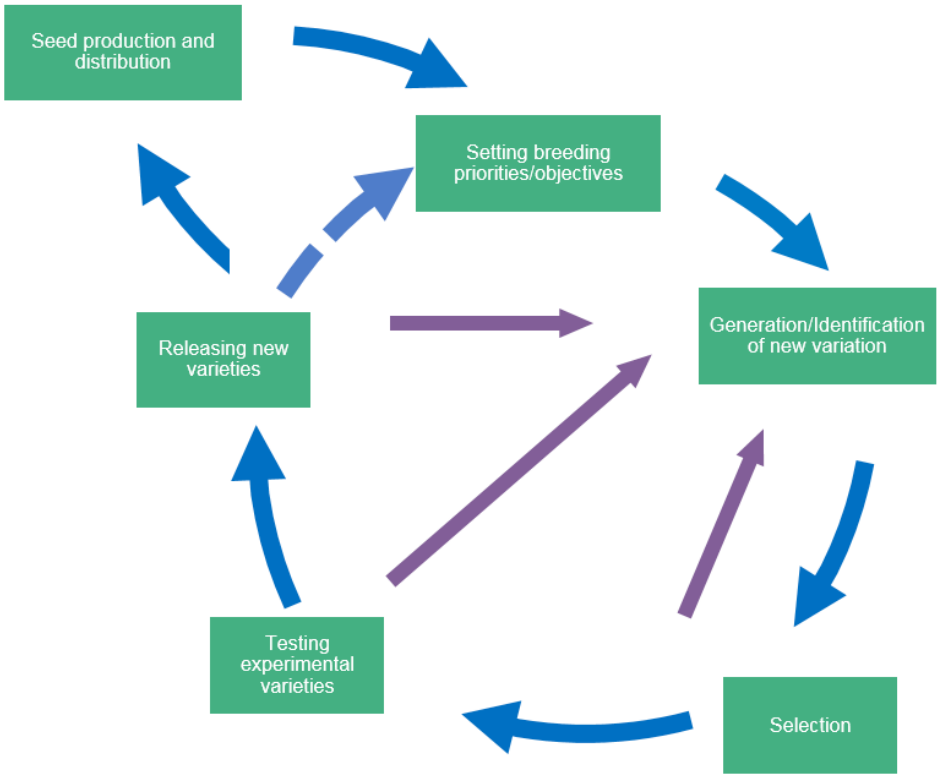
- When is it useful to consider the different preferences, needs, and objectives of men and women end-users?

Gender differences: Ubiquitous but poorly understood

Since the 1980s, researchers have generated a large but scattered body of evidence on the varietal preferences of poor farmers (with relatively few studies focusing on livestock), but have employed gender analysis only sporadically. Over the decades, smallholder farmers' conditions have shifted significantly, as a result of demographic transitions, increased market integration, and climate change. Yet, few studies have analyzed the consequent shifts in farmers' trait preferences or the gender dimensions of such changes.

Since studies on farmers' varietal preferences involve diverse approaches, it is difficult to compare them or aggregate their findings. Nonetheless, the evidence does suggest that social- and gender-differentiated trait preferences – while varying in degree – are ubiquitous across crops, regions, agro-ecosystems, and cultures.

Figure 3: Main stages of a plant breeding program



Purple arrows signify recycling of genetic material in recurrent breeding cycles

Note: The plant breeding cycle is a dynamic and iterative process, where the crop improvement teams make decisions at all stages.

Adapted from a presentation by Stefania Grando at the gender, breeding, and genomics workshop (Grando, 2016).

Original source: Weltzien, E.et al., 2003.

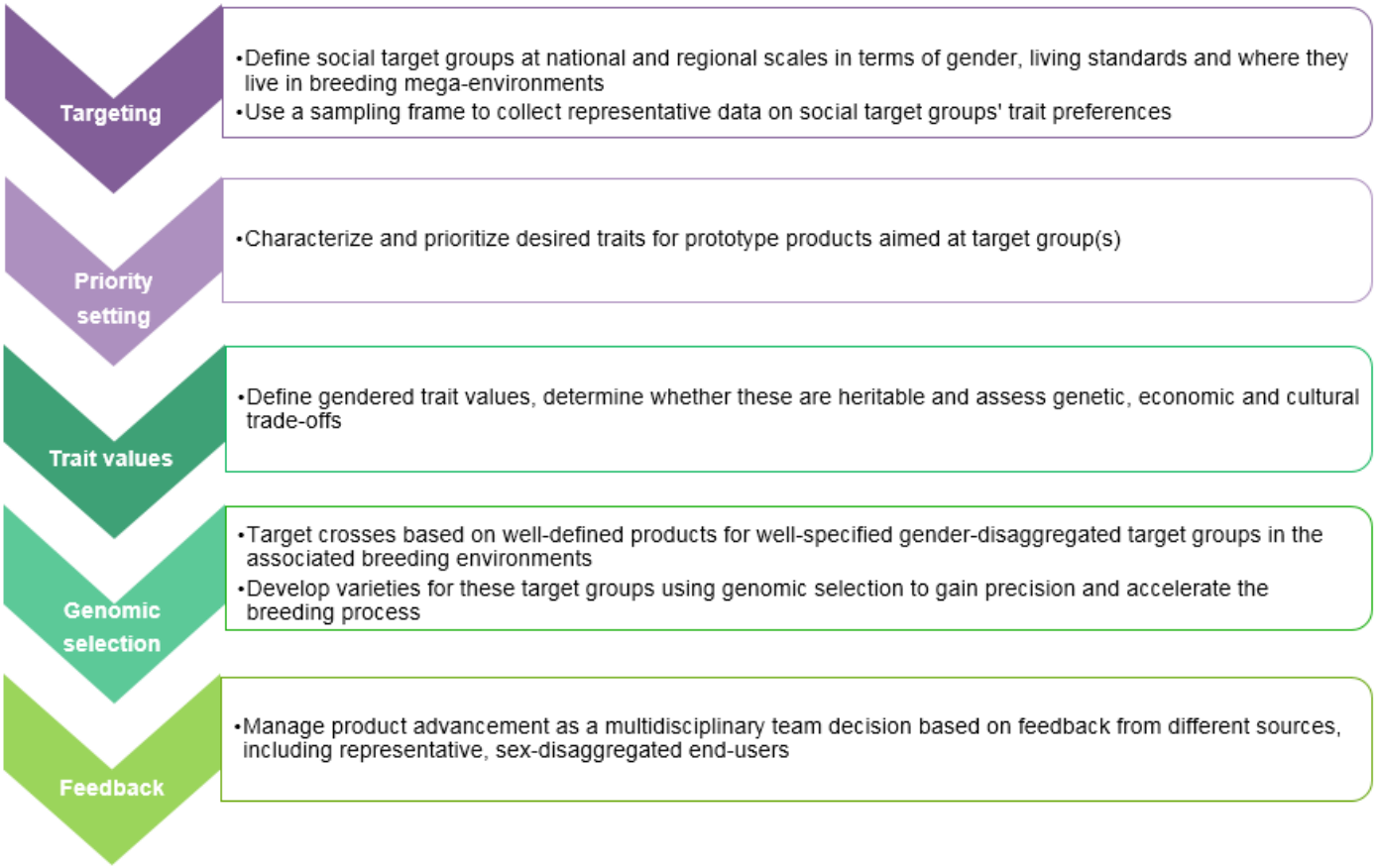
In May 2016, the CGIAR Gender and Agriculture Research Network commissioned a literature review on gender differences in end-users' trait preferences, with a focus on evidence and issues. The review encompassed key papers, reports, and dissertations published from 1985 to 2016. The resulting analysis summarized the "state of the art" knowledge gaps as well as the strengths and weaknesses of the various approaches used. The key findings are summarized as follows:

Insufficient data: Of the 300 relevant studies, only 31 report results on gender-differentiated trait preferences. Many studies mention that data were collected from both women and men but provide no sex-disaggregated results, discussion, or analysis.

Methodological weaknesses: Studies did not use a research design that would enable rigorous comparisons. Most studies simply fail to explain when, where, and why gender differences do or do not exist.

Significant gaps in evidence: very few reports on trait preferences for women's crops such as vegetables, groundnuts, etc. In addition, there weren't many cases with conclusions or outcomes regarding the change of breeding design due to the inclusion of gender considerations.

Figure 4: Summary of "must-have" features of a gender-responsive breeding program



Source: The "must-have" features of gender-responsive plant or animal breeding. Mascarenhas, 2016.

"Must-have" features of gender-responsive breeding

The analysis carried out during the workshop, by both quantitative and qualitative researchers, provided the basis for a series of foundational inputs from social science, which are summarized below:

Clearly define the target population as well as the social and physical environment at the outset of the breeding program.

Diagnostic demographic and market studies conducted at the "front end" of the breeding cycle can help the breeding team identify social target groups that are well defined not only in terms of gender but also other socio-economic characteristics. Breeders can then prioritize not only the target groups they are breeding for — but also the potential products in demand by particular target groups. They can also ensure that the geographic scale of socio-economic targeting is congruent with that of the breeding environment.

Use sampling to ensure that gender differences to be addressed by breeding are representative of social target groups at national and regional scales

To successfully define a target environment and beneficiary population, a sampling framework must be established for socioeconomic diagnosis and priority setting. Customer segmentation, routinely used in the private sector, is a useful way to define social target groups for breeding and can be carried out by mining large-scale national or international surveys – using, for example, Living Standards Measurement Study (LSMS)[2] surveys , some of which provide relevant sex-disaggregated data that can be used for targeting. Poverty mapping generated by geographic information systems (GIS) can be used to relate the demographic distribution of target groups to the geographic distribution of breeding environments.

The potential for overlays of environmental and climate change maps with the demographic features of target groups needs to be explored. Large scale analysis conducted within a sampling framework can provide a coarse differentiation of social groups that can then be linked to gender analyses conducted at much finer scales; in farms, households, villages and landscapes for example. This cross-scale gender analysis will assist breeding programs to set priorities among gender-differentiated populations as well as different geographic environments. If sampling is used to frame gender analysis, breeding teams can then be confident that the gender-differentiated end-user preferences they consider addressing through breeding, are representative of preferences found in socially and economically important populations.

Characterize and prioritize traits desired by different target groups

Breeders' choice of which traits to work on depends on whom the breeding program decides to work for. Once the target populations and environments of importance have been broadly defined, breeders must have detailed information about the trait preferences and socioeconomic characteristics of representative members of the program's social target groups, differentiated by gender. In order to set priorities, trade-offs between traits and trade-offs between social groups (with preferences for one trait over another) must be analyzed. The social and the breeding priorities will be interdependent. For example, breeders might face a choice between early maturity and higher yield: if men selling the crop prioritize yield and women using the crop for household consumption prioritize early maturity, the program has to decide not only which trait to prioritize, but whether male or female preference is most important.

It is important that breeding teams consider the gendered norms, roles, and responsibilities that these preferences reflect because of their influence on production and consumption behavior. In our example, women might prevent men from adopting a late maturing variety even if it is higher yielding. Yet it may be easier to breed for yield. Clearly

[2] The Living Standards Measurement Study (LSMS) is a household survey focused on generating high-quality data. It collaborates with the Demographic Health Surveys (DHS) and the Multiple Indicator Cluster Surveys (MICS). LSMS surveys have been conducted in dozens of countries around the world.

women's preferences will not always be a priority. A program will have to make difficult choices in order to prioritize a given target group and their preferred trait(s), as otherwise they risk working on too many traits and failing to make gains in any of the traits.

Once representative individuals, households, farms or communities can be selected with confidence, in-depth qualitative studies are needed on how gender differences affect farmers' access to and use of genetic resources, and how this feeds into producers' and consumers' trait preferences. These must be evaluated across the entire value chain - from producers, traders, processors, and transporters to urban and rural consumers. A further key step is to evaluate future scenarios for these social groups and their aspirations with respect to crop varieties and livestock breeds, giving special consideration to gender differences.

Tools for priority setting

Multiple methods can be used to prioritize and characterize preferred crop and livestock traits:

- Choice experiments
- Games and multi-agent modeling
- Conjoint analysis
- Sex-disaggregated focus groups selected using the sampling frame
- Foresight modeling, using system, crop, or economic models
- Participatory evaluations of materials with contrasting traits to learn about trade-offs
- Participatory scenario evaluations, based on projection from recent changes
- Sets of diverse varieties for on-farm evaluation by men and women producers

Target crosses based on well-defined products for well-specified gender-disaggregated target groups in the associated breeding environments

A must-have is to choose parents that combine as many as possible of the desired target traits to ensure that selection can focus on the lowest possible number of traits, so genetic progress can be achieved for one or a few priority traits. Landraces that are valued differently by men and women representatives of the target groups can be an important source of desirable trait combinations, especially when genetic or genomics tools are available for the traits that require genetic improvement. Genomic selection can then be used to refine the size of the breeding population developed for a target group.

Define trait values by measuring priority traits, determining whether they are heritable, and assessing the genetic, economic, and cultural trade-offs

Breeding objectives and ideotypes (i.e., model plant types) must be formulated on the basis of (1) detailed definitions of trait values from the end-user´s perspective together with measured trait qualities (e.g., sweetness); (2) the options for genetic and molecular breeding and (3) an understanding of the associated genetic, economic, and cultural trade-offs.

Manage multi-season selection, using genomic selection when feasible to identify the desired genotypes more precisely and to accelerate selection

This should take place in tandem with the decentralization of selection to locations chosen with reference to priority target groups and environments. Farmer-participatory breeding trials should be part of the process. In organizing these, farmers and other end-users must be chosen to represent particular target groups. End-users must be allowed to participate as well in all relevant stages of selection. In addition, gender-disaggregated data must be collected from participants in farmer-managed trials with reference to the sampling frame.

Manage product advancement based on multidisciplinary team decisions that take into account feedback from different sources

Decisions about which genetic materials to advance and which to cull during screening and evaluation must be made on the basis of a multi-disciplinary assessment. This should include consultations at appropriate stages with a representative end-user panel as well as variety release committees. End-user feedback on varietal or animal performance is vital and can be collected from representative target groups, using different evaluation methods, such as formal trials and farmer experimentation.

Tools for developing varieties with partners

- Platforms for management of breeding data
- Appropriate trial evaluation designs (e.g., partially replicated, or p-rep)
- Advanced statistical methods (mixed models and spatial analysis)
- Techniques such as genomic selection and genome editing
- Participatory Varietal Selection, used at different stages to generate representative sex-disaggregated data on trait preferences and to identify rejected materials or materials to advance

How would a gender-responsive breeding program operate?

Gender-responsive breeding programs depend on a collaborative approach to targeting, implementation, and monitoring that involves multi- or trans-disciplinary teams. For example, social scientists are needed to carry out the front-end analysis that is essential for gender- responsive breeding, in which particular trait preferences are associated with particular types of end-users. During the workshop on gender, breeding, and genomics, participants recognized that interdisciplinary teams are vital throughout the breeding process – from targeting and priority setting all the way to implementation, dissemination, and monitoring and impact assessment.

What will it take to bring about change?

The gender and breeding working group of the CGIAR Gender and Agriculture Research Network has fostered greater willingness among CGIAR researchers to adopt a more gender-responsive approach in breeding. This will translate into significant and sustained progress only if heightened interest leads to institutional change and buy-in from leadership.

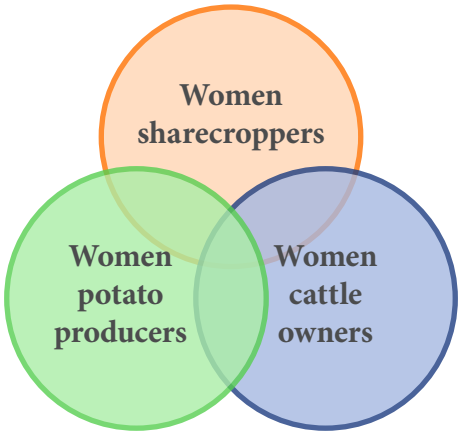
As a first step in this direction, organizations must form multi-disciplinary teams focused on developing products for well-defined target groups. Breeding team members and management must then provide the support that client-oriented researchers need in order to deliver clear target group definitions and priorities for implementation. Another key requirement for change is an enabling environment that fosters collaboration, communication, and sharing of knowledge and data across disciplines. Finally, management must develop and implement a system of rewards and continuous assessment that motivates team members to ask at every step in the breeding program (1) who we are breeding for? and (2) what is the demand?

As CGIAR breeding programs become more gender responsive, it will be useful and important for researchers to apply the insights described below:

1. Breeders can use information about gender preferences at early stages in testing rather than relegate inputs from gender analysis to later steps in the breeding cycle.

2. Users´ preferences are shaped by gender as well as other social characteristics, so just differentiating women from men is misleading, since this ignores the existence of different segments in a female population.

Figure 5: Users' preferences are shaped by more than gender alone



Source: Ashby, 2015.

As illustrated in Figure 5, for example, a group of women sharecroppers who grow potato but lack cattle have quite different interests from others, such as the group of women potato producers who do own cattle and are not sharecroppers. While the interests and preferences of these groups may overlap to some extent, it is important to not lump them together in a single market segment or end-user group defined simply as "women." Not all women have the same perspectives, interests, and preferences; intersectionality as it is known is when gender interacts with other social characteristics as well, such as social class, wealth, age, race, ethnicity, and religion. Thus, women in a given social class may have varietal preferences that are similar to those of men in the same social class but very different from those of other women in a different social class. While gender may sometimes be the most significant factor accounting for different trait preferences, it is important to recognize that it is not always the case.

3. If gender analysis indicates that priority be given to many desirable traits that are genetically complex, the workload of a breeding program could soon become unmanageable. Genomic approaches can potentially help by enabling breeders to address gendered trait preferences with greater precision and speed. For example, if they know which genes are responsible for a trait such as kneading quality, they can screen genetic resources more quickly to determine which materials to use as parents, or which materials to advance the early stages of selection, where very large numbers of materials need to be managed.

4. The "front-end" study that provides breeders with a definition of their target groups in terms of gender and other socio-economic characteristics should be carried out on a large geographical scale in mega-environments defined for breeding purposes. The study should also use a sampling frame to ensure that information on gender-differentiated trait preferences (collected in households and communities) is representative of the program's social target groups.

5. To ensure that breeding programs reach their target groups and generate development impact, analyses must be conducted and evidence gathered on the degree to which variety development should take into account gender-based trait preferences.

Where to go from here

While many breeders in CGIAR are aware of how gender differences can influence variety adoption and the impact of plant and animal breeding programs, they do not yet have much clarity about how these differences do or should affect the way they work. As part of the search for answers, this brief describes the key features that a gender-responsive breeding program should have, some entry points for addressing gender issues, and key requirements for implementing such programs across the CGIAR System.

There are still obvious gaps in our knowledge about gender and breeding, which are reinforced by a lack of evidence from research. As this work advances, however, it should be possible to provide crop improvement teams with more specific guidelines and a more detailed description of what a successful gender-responsive breeding program should look like and what practical steps must be taken to achieve this end. It is therefore urgent and important that researchers take these steps: (1) reduce the gender and breeding knowledge gap by building the evidence base; (2) foster buy-in from management by disseminating the recommendations that emerged from the workshop on gender, breeding, and genomics; and (3) enhance research capacity through coaching and mentoring to form a cadre of researchers who are equipped to implement gender-responsive breeding methods.

References

Ashby, J. 2015. Gender Responsive Research in the CGIAR. Slide 31. Presentation. https://www.slideshare.net/CIAT/gender-responsive-research

Grando, S. 2016. Structure of a breeding program. Slide 2. Presentation. https://www.dropbox.com/s/i9chne258ilcj7x/S-Grando_Breeding%20Program_GBG.pptx?dl=0

Mascarenhas, M. 2016. The "must-have" features of gender-responsive plant or animal breeding. Workshop summary. CGIAR Gender and Agriculture Research Network. Cali, Colombia. 4 p. http://hdl.handle.net/10568/78078

Weltzien, E.; Smith, M.; Meitzner, L; Sperling, L. 2003. Technical and institutional issues in participatory plant breeding- From the perspective of formal plant breeding: a global analysis of issues, results, and current experience. CGIAR Systemwide Program on Participatory Research and Gender Analysis for Technology Development and Institutional Innovation; Centro Internacional de Agricultura Tropical (CIAT). 208 p. -- (PPB Monograph; no.1). Cali, Colombia. http://ciat-library.ciat.cgiar.org/articulos_ciat/ppb_monograph_1.pdf

Weltzien, E., et al. "Gender differentiation among farmer preferences for varietal traits in crop improvement." Slide 12. Presentation. https://www.dropbox.com/s/93y234j5gusjphn/Review%20gender%20differentiated%20trait%20preferences.pptx?dl=0

Further Reading

CGIAR Consortium Board. 2011. Consortium Level Gender Strategy. CGIAR Consortium. Agropolis International, Montpellier, France. 12 p. http://hdl.handle.net/10568/77559

CGIAR Consortium Office. 2014. Proposed Actions to speed up Gender Research Mainstreaming in CGIAR. Working Document. http://hdl.handle.net/10947/3004

Webpages and Tools

CGIAR Gender. Gender Breeding. Webpage. https://gender.cgiar.org/themes/gender-and-breeding/

CGIAR Gender. Gender, Breeding and Genomics Workshop. Webpage. https://gender.cgiar.org/gender-breeding-and-genomics-workshop/

The World Bank. Living Standards Measurement Study (LSMS). Webpage. http://microdata.worldbank.org/index.php/catalog/lsms

About gender in CGIAR

Adopted in 2012, the CGIAR system level gender strategy set the agenda for how all new global CGIAR Research Pro grams (CRPs) would integrate gender into research activities.

The Gender Research Action Plan (GRAP) was resourced by the CGIAR Fund Council to address the need to enhance capacity development in gender analysis for agriculture in the CRPs.

The CGIAR Gender and Agriculture Research Network was a cross-CGIAR Research Program community of practice for researchers, principally social scientists, whose work focused on or included gender. As of 2017, the Network has evolved into the CGIAR Collaborative Platform for Gender Research hosted by the CGIAR Research Program on Policies, Institutions and Markets (PIM) and coordinated by the Royal Tropical Institute (KIT) in Amsterdam.

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About this brief series

This is four of a set of four briefs that provide a final report of the activities, achievements and lessons learned in the Gender Research Action Plan.These briefs are intended to (1) provide an overview of activities, achievements, lessons learned and opportunities in key areas, (2) provide support and resources for members of the network to more rapidly implement collaborative work in Phase II of the CRPs, and (3) facilitate members' knowledge sharing, given different levels and types of gender expertise, through more effective and accessible mechanisms for cross-learning and good practice exchanges via the Gender Network.

This brief was prepared for the CGIAR Gender and Agriculture Research Network by Martina Mascarenhas, Coordinator for Communications, Knowledge Sharing, and Data Management Support of the CGIAR Gender and Agriculture Research Network at the International Center for Tropical Agriculture (CIAT) and Jacqueline Ashby, CGIAR System Management Office. Support was also received from Graham Thiele, CGIAR Research Program on Roots, Tubers and Bananas (RTB); and Natalie Orentlicher, from the knowledge sharing support team of the International Center for Tropical Agriculture (CIAT). The views expressed in this document are solely those of the authors and cannot be taken to reflect the official opinions of the CGIAR Gender and Agriculture Research Network.

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Cover photo: Improving potato yields for farmers in the Usambara Highlands in Lushoto, Tanzania. The shirts of the farmers
read "Potatoes are both a source of food and income" in Swahili. Photo credit: Sara Quinn, International Potato Center (CIP).

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We would like to thank all donors who supported the CGIAR Gender Research Action Plan through their contributions to the CGIAR Fund: http://www.cgiar.org/about-us/our-funders/